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A Comparison Of Body Weight, Percent Of Body Fat, Flexibility, And Agility Among Female Athletes From Four Selected Sport Groups And Modern Dancers

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A COMPARISON OF BODY WEIGHT, PERCENT OF BODY FAT, FLEXIBILITY, AND AGILITY AMONG FEMALE ATHLETES FROM FOUR SELECTED SPORT GROUPS AND MODERN DANCERS

SEUNG HO YOON

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A Comparison of Body Weight, Percent of Body Fat, Flexibility, and Agility among Female Athletes from four Selected Sport Groups and Modern Dancers

(TITLE)

BY

Seung Ho Yoon

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Abstract

A COMPARISON OF BODY WEIGHT, PERCENT OF BODY FAT, FLEXIBILITY, AND AGILITY AMONG FEMALE ATHLETES FROM FOUR SELECTED SPORT GROUPS AND MODERN DANCERS

This study was conducted to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance groups. For the purpose of this study, the null hypothesis was assumed to the effect that there are no significant differences in body weight, percent of body fat, flexibility, and agility between groups of college women varsity athletes in volleyball, swimming, track, cross country, and modern dancers.

Thirty-seven female varsity athletes representing volleyball, swimming, track, and cross country and eight modern dancers at Eastern Illinois University served as subjects for the investigation.

Body weight was determined by weighing each subject, wearing only athletic top and pants, on a calibrated balance scale. The reading, which was recorded to the nearest half pound, was converted to kilograms by dividing by 2.2.

A Lange Skinfold Caliper was used for the skinfold measurements. Supra-iliac and triceps skinfold measurements were taken to determine body density and percent of body fat. Measurements were taken on the right side of the body

with the subject in a standing position. Each skinfold measurement was taken two times and the average of the two trials was the score. However, when there was more than .5 millimeter difference between the first two trials, the third measurement was taken and the average of the three tials was recorded as the score.

The sit and reach test, using a Trunk Flexibility Tester, was administered to measure the degree of hip and lower back flexion as well as the extension of the hamstring muscles of the legs. Ths subjects performed leg stretching exercises prior to the test. One practice trial was given. The reading was recorded to the nearest .5 centimeter and the best of three trials was the score.

The SEMO agility test was administered to measure the general agility of the body in maneuvering forward, backward, and sideward. The basketball court was utilized as the testing area. One practice trial was given to each subject before being tested and the best of two trials to the nearest .1 second was recorded as the score.

The t-test for independent samples was applied to determine whether significant differences existed between mean scores of the tests. The .05 level of confidence was selected to denote statistical significance for the study.

Based on the data presented in this study, the null hypothesis is rejected since, in a number of instances, differences exist among the groups tested on body weight, percent of body weight, flexibility, and agility.

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CHAPTER ONE

INTRODUCTION

While females have competed successfully in athletics for many years, the athletic arena has traditionally been the domain of the male. In 1972, there were 251 college varsity basketball teams for women in the United States, and in 1974, there were 95 intercollegiate track and field teams. Today, there are 883 and 489 teams for these respective sports (30). This increase in programs has resulted in a greater number of women participants. Many of the games played by women during the early 1970's have developed into popular intercollegiate activities of the present day. Some of the activities include volleyball, basketball, swimming, cross country, field hockey, track and field, golf, and tennis.

It may be assumed that an individual's physique and body composition could be either a limiting factor or, in some instances, a contributing factor to the individual's success as a participant in one activity or another. In an attempt to determine the degree to which the physical characteristics of the female athlete affect her performance, physical tests such as body weight, skinfolds, flexibility, and agility could be utilized. Knowledge gained from the administration of tests and the analysis of such data could be valuable in assessing the status of the female

athlete relative to her physical characteristics and her status as a participant.

Statement of the Problem

The purpose of this study was to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance.

Null Hypothesis

In this study, the following null hypothesis was tested: There is no difference in body weight, percent of body fat, flexibility, and agility among groups of college women athletes in volleyball, swimming, track, cross country, and modern dance.

Needs for the Study

Accompanying the increase in the population of women athletes has been an increase in the number of published reports on women and women athletes (4, 7, 12, 19, 20). Despite this increased emphasis, limited scientific data are available on the physical characteristics, flexibility, and agility of the collegiate sports women.

All people, especially athletes in training, need a certain amount of body fat to be healthy. Fat, or adipose tissue serves two vital functions, providing energy storehouses for the body and protecting the body from trauma due to external forces (40). Although body weight can

be used to roughly assess the fatness of an athlete, body weight alone reveals little with respect to athletic performance. It is considered more appropriate to evaluate the fat composition of the body (40). Johnson and Nelson (21) stated that flexibility tests can be utilized as a means to determine potential in certain sports activities and to diagnose the extent of a previous injury or the cause of poor posture. Also, agility tests can be utilized as a tool for predicting potential in different sports activities and as an identifying factor in general motor ability tests.

If coaches are to be effective, and if women athletes are to reach the height of performance of which they are capable, their knowledge in this area must be increased.

Limitations

The number of subjects involved in the testing procedure was relatively small which could exert some limitation in applying results to the general population.

The search was confined to women athletes of Eastern Illinois University and to participants in five activities only.

Definition of Terms

The following terms are defined as they were used in this study.

Agility

According to Johnson and Nelson (21), agility is defined as "the physical ability which enables an individual to rapidly change body position and direction in a precise manner."

Anthropometry

Anthropometry can be defined as the science of measuring the human body and its parts and functional capacities especially as an aid to the study of human evolution and variation.

Flexibility

Flexibility refers to the ability of a joint to move through one hundred percent of its possible movement range; it is dependent upon muscle length and can be static or dynamic in nature (10).

Modern Dance

Modern Dance is an American contemporary art form of the moving body. The elements of modern dance are time, space, rhythm, and energy.

SEMO

SEMO refers to Southeast Missouri State University where the agility test used in this study was developed.

Varsity Athletes

Varsity athletes are those females in college who have been playing in collegiate varsity competition.

CHAPTER TWO

RELATED LITERATURE

The purpose of this study was to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance.

The following is a review of the literature pertaining to body weight and composition, flexibility, and agility.

Body Weight and Composition

In an attempt to determine the role of various physiological and anthropometric measures in determining mile run times, Berg and Bell (3) found that body weight is significantly related to run times indicating that heavier body weights are associated with slower times and that body weight is positively associated with VO_2 max expressed in liters divided by minutes (1/m), but negatively related when expressed in milliliters divided by kilograms times minutes (ml/kg·min).

Stone (40) suggested that coaches should take the simple precaution of having all athletes compete at appropriate body weights.

Body fat and body composition measurements have been used to classify and quantify the physical characteristics of athletes. Parizkova and Poupa (31) reported a mean value

of 9.6 percent relative fat for highly trained female gymnasts.

Laubach and McConville (24) found that the greater the amount of body fat a person has, as measured by calipers, the smaller will be the range of motion in certain joints of the body.

Leedy (25) indicated that physical performance items where the whole body of an individual is forced to move are dependent on the percent of lean body mass rather than the amount of the lean body mass.

Several investigators (11, 22, 23, 27, 28) have determined that anthropometric factors and body fat percentage account for a considerable amount of variance in endurance events.

Sinning and Lindberg (36) reported a mean value of 15.5 percent for college age female gymnasts. In a separate study (35), Sinning found female basketball players to average 20.8 percent relative fat, while Wilmore (41) found female swimmers to average 29.6 percent. However, Morrow and Hostler (30) reported that the basketball and volleyball players are most like distance runners and sprinters in terms of percent of body fat.

Wilmore (41) reported that in body composition, the 18 to 22 year-old females average between 22 and 26 percent relative body fat.

Pipes (32) stated that while there would seem to be a predisposition of body type that would influence the indi-

vidual's ability to perform in an event, it may also be that the training procedures for these specific events are common, and this may account for the finding of proportionate percentage of relative body fat for men and women in a particular event.

Berg and Bell (3) found that estimated body fat was significantly related to run times at 60 yards, 440 yards, and one mile indicating that higher percentages of body fat were associated with slower run times.

In an analysis of factors explaining performance in the marathon, Solvic (38) found that faster runners were leaner. Other investigators (11, 16, 22, 39) have also found significant correlations between body fat and running performance.

Brown and Wilmore (4) studied the physical and physiological profiles of champion women long distance runners and found these women had ectomorphic body builds and little body fat. They have reported data on nine female distance runners and the mean values for height, weight, density, percent fat, and lean body weight (LBW) for the group were 167.4 cm, 50.7 kg, 1.0701, 12.6 percent, and 44.2 kg respectively. In a separate study (5), they found that women competing in the field events had considerably more body mass, and in the case of shot-putters, much more body fat.

Dolgner and Spasoff (18) stated that modern dancers are concerned about their appearance and therefore may be conscious of their caloric intake in order to maintain a

low body weight. They also stated that modern dancers usually appear exceptionally lean with well-defined lower extremety musculature, particularly the thigh and calf.

Beal (1) concluded that the anthropometric measurements that showed any real significance in relation to modern dance performance was the length of the thigh.

Flexibility

Johnson and Nelson (21) defined flexibility as "the ability of an individual to move the body and its parts through as wide a range of motion as possible without undue strain to the articulations and muscle attachments."

Cureton (14) stated that flexibility exercises, if built up to sufficient dosage, may condition muscles, tendons, ligaments, and bones to greater tensile strength and elasticity.

de Vries (17) stated that flexibility is the range of movement of a joint or a series of joints.

Corbin and Noble (9) stated that flexibility, recognized by most physical educators and exercise experts as an important component of health related fitness, can be defined as "the range of motion available in a joint or group of joints," and it is generally agreed that muscles and ligaments are most important in determining flexibility, while tendons are less important.

Corbin et al (10) stated that adequate flexibility can contribute to increased work performance, increased

resistance to muscle injury and soreness, and a general state of good health.

In an attempt to determine the relationship between flexibility of the hip joint and length of body segments of college women, Shaw and Bohnen (34) found no significant relationship between selected aspects of flexibility and the various anthropometric measurements.

Laubach and McConville (24) found that the correlations between the flexibility and the anthropometric measurements were low and mostly insignificant in an attempt to investigate the relationships between various aspects of flexibility and selected anthropometric measurements of college men.

Agility

Cureton (15) stated that agility emphasizes the ability to react quickly in controlled, nimble movement, "rabbit like" in action - the ability to move quickly, dexterously, and easily. Agility represents one of the highest types of neuromuscular training.

Clarke (7) defined agility as skills requiring rapid movement of the entire body, in different directions and in response to unexpected circumstances, as dodging in football, pivoting in basketball, and agile stunts in tumbling.

Cumbee (13) stated that the Burpee test as a measure of agility is a poor choice because of the low correlation of this test with the quick change of direction factor. He further stated that the use of such tests as the side-

step, zig-zag run and the dodging run might give more evidence that the type of ability involved in agility is a quick change of direction.

Johnson and Nelson (21) stated that by the proper use of agility tests, it is possible for the physical education teacher to determine which individuals in class are most agile and which ones need work in agility in order to better perform the particular activity.

Benton (2) found that dance movement was not based entirely upon rhythm. The results of his study seemed to show that such elements as agility, flexibility, and motor educability were also important.

Morrow and Hostler (29) concluded that the most successful teams in a collegiate volleyball tournament have the most strength and agility; whereas, the poorest teams were weaker, and performance factors were related to team success of women intercollegiate volleyball players.

Summary

A review of literature revealed that percent of body fat has a significant effect on athletic performance and body composition of female athletes tends to vary considerably with the sport in which she is participating.

The various studies on flexibility indicated that there is no significant relationship between the anthropometric measurements and flexibility.

Agility has been generally recognized as one of the

most important physical fitness factors to all kinds of sports activities.

CHAPTER THREE

METHODOLOGY

This study was concerned with the body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance.

This chapter presents the procedures used in the study including the selection of the subjects, a description of the tests and how each test was administered, and the statistical analysis.

Subjects

The subjects for this study consisted of 45 female students, ranging in age from 17 to 21 years, from Eastern Illinois University. The participants were from five groups including 11 from volleyball, 9 from swimming, 8 from track, 9 from cross country, and 8 from modern dance.

Testing Procedures

The tests administered in this study were designed to determine body weight, percent of body fat, flexibility, and agility. Each of the tests has been described in this section.

Body Weight

Body weight was determined by weighing each subject

on a calibrated balance scale manufactured by the Continental Scale Works, Chicago, Illinois. Each subject, wearing only athletic top and pants, was weighed to the nearest half pound while standing in a steady position in the center of the platform of the balance scale. The reading was converted to kilograms by dividing by 2.2.

Skinfolds

A Lange Skinfold Caliper manufactured by the Cambridge Scientific Industrials, Inc., Cambridge, Maryland was used for this test.

Supra-iliac and triceps skinfold measurements were taken to determine body density and percent of body fat. The supra-iliac measurements were taken just above the crest of the ilium at the midaxillary line. The fold was lifted diagnally, following the natural line of the iliac crest. The triceps measurements were taken on the back of the arm midway between the acromion process and the olecranon process with the caliper applied to the long axis of the arm. The skinfold was grasped between thumb and index finger and attached the jaws of the caliper about one centimeter from the thumb and finger. The measurements are in millimeters. Each subject was asked to contract the underlying muscle. Measurements were taken on the right side of the body with the subject in a standing position.

Each skinfold measurement was taken two times and the average of two trials was recorded as the score. However,

when there was more than .5 millimeter difference between the first two trials, the third measurement was taken and the average of the three trials was the score. The first and second scores of the triceps skinfold test were used to determine reliability. A coefficient of correlation of .98 was established.

The Sloan (37) formula for predicting body density and percent of body fat from skinfold measurements are as follows:

Body Density = 1.0764 - .00081 (supra-iliac) - .00088 (triceps)

Percent of Body Fat = (4.570/Body Density) 100

Flexibility

The sit and reach test was administered to measure the degree of hip and back flexion as well as the extension of the hamstring muscles of the legs.

A Trunk Flexibility Tester produced by Health and Education Services Division of Novel Products Inc., Addison, Illinois was used as the measuring instrument.

In this test, a study by Johnson and Nelson (21) established a coefficient of correlation of .94 and .99 for reliability and objectivity respectively.

The subjects were allowed to perform leg stretching exercises before positioning. The Trunk Flexibility Tester was located on a table to eliminate the subjects from lowering and raising themselves from the floor, thus avoiding possible embarrassment from the incapacity to perform these tasks.

The subjects sat on the table with knees in a locked out position. The feet were placed against the front of the box with shoes removed. The subjects extended their arms forward with the both hands, one on top of the other, and pushed the slide rule as far as possible in one continuous movement and held for two seconds. One practice trial was given. The reading was recorded to the nearest .5 centimeter and the best of three trials was the score.

Agility

The SEMO agility test was administered to measure the general agility of the body in maneuvering forward, backward, and sideward. The free throw lane of the basketball court in the south gym of McAfee Gymnasium was utilized as a testing station. Equipment consisted of four plastic cones with nine by nine inch bases, and 12 inches in height, a stopwatch, and marking tapes.

In this test, a study by Johnson and Nelson (21) established a coefficient of correlation of .88, .97, and .63 for reliability, objectivity, and validity respectively.

A diagram of the movement pattern of the SEMO agility has been presented in Figure 1. The subject lined up, outside the line AB with her back to the line, and she waited for the signal "ready, go." The subject sidestepped from A to B, and passed outside the corner cone. She then backpedalled from B to D, and passed to the inside of the corner cone. She then sprinted forward from D to A, and passed

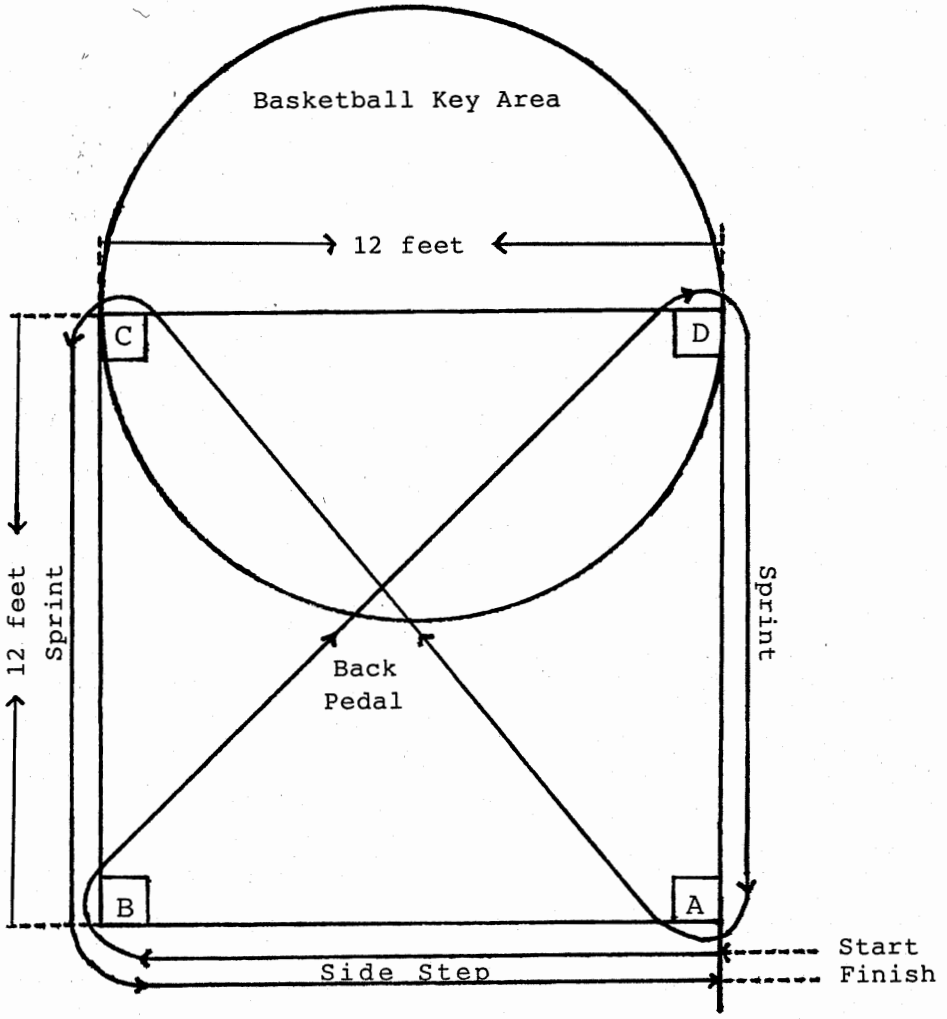

Figure 1

The SEMO Agility Test

outside the corner cone. She then backpedalled from A to C, and passed inside of the corner cone. She then sprinted forward from C to B, and passed outside of the corner cone. And finally, she sidestepped from B to the finish line at A. One practice trial was given to each subject before being tested, and the best of two trials recorded to the nearest .1 second was the score.

Statistical Procedure

A statistical treatment was applied to the data collected in this study. The t-test (8) for independent samples was applied to determine whether significant differences existed between mean scores of the tests. For this study, the .05 level of confidence was selected to denote statistical significance.

The scores obtained from triceps measurement was used in determining a reliability of the skinfold tests using the Pearson Product Moment Method (21).

CHAPTER FOUR

ANALYSIS OF DATA

The primary purpose of this study was to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance groups. Thirty-seven female varsity athletes and eight modern dancers were selected as subjects for this study.

The presentation of data along with a discussion have been included in this chapter.

Presentation of Data

The data have been organized to present a comparison of body weight, percent of body fat, flexibility, and agility among the four collegiate female varsity teams and the modern dance group.

Comparison of Body Weight

The body weight scores in kilograms (Kg) for the female athletes in volleyball, swimming, track, cross country, and the modern dance group along with mean scores, standard deviations, and the t-test results have been placed in Table 1.

Following is a summary of the mean body weights for each group and their respective standard deviations. These scores are also depicted graphically in Figure 2.

Table 1

Comparison of Body Weight Scores among Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

Subject	Volleyball (A)	Swimming (B)	Track (C)	Cross Country (D)	Modern Dance (E)
1	66.4	64.5	51.8	45.5	46.6
2	68.2	50.9	60.2	53.6	53.6
3	61.8	68.2	55.9	55.7	55.0
4	69.1	58.2	52.3	49.1	52.3
5	58.9	63.9	63.2	59.1	60.0
6	68.2	65.9	66.8	58.0	56.6
7	67.3	56.4	63.2	57.7	61.8
8	66.4	62.7	70.0	50.9	59.3
9	85.9	61.4	-	62.0	-
10	71.4	-	-	-	-
11	61.6	-	-	-	-
Mean	67.75	61.34	60.43	54.62	55.65
S.D.	7.07	5.36	6.64	5.30	4.91

Mean Difference

	B	C	D	E
A	6.41	7.32	13.13	12.10
B		0.91	6.72	5.69
C			5.81	4.78
D				1.03

t-ratio

	B	C	D	E
A	2.29*	2.31**	4.71*	4.36**
B		0.31	2.68***	2.28****
C			2.00	1.64
D				0.42

Significant Difference ($p<.05$) *df = 18; t = 2.101 ***df = 16; t = 2.120
**df = 17; t = 2.110 ****df = 15; t = 2.131

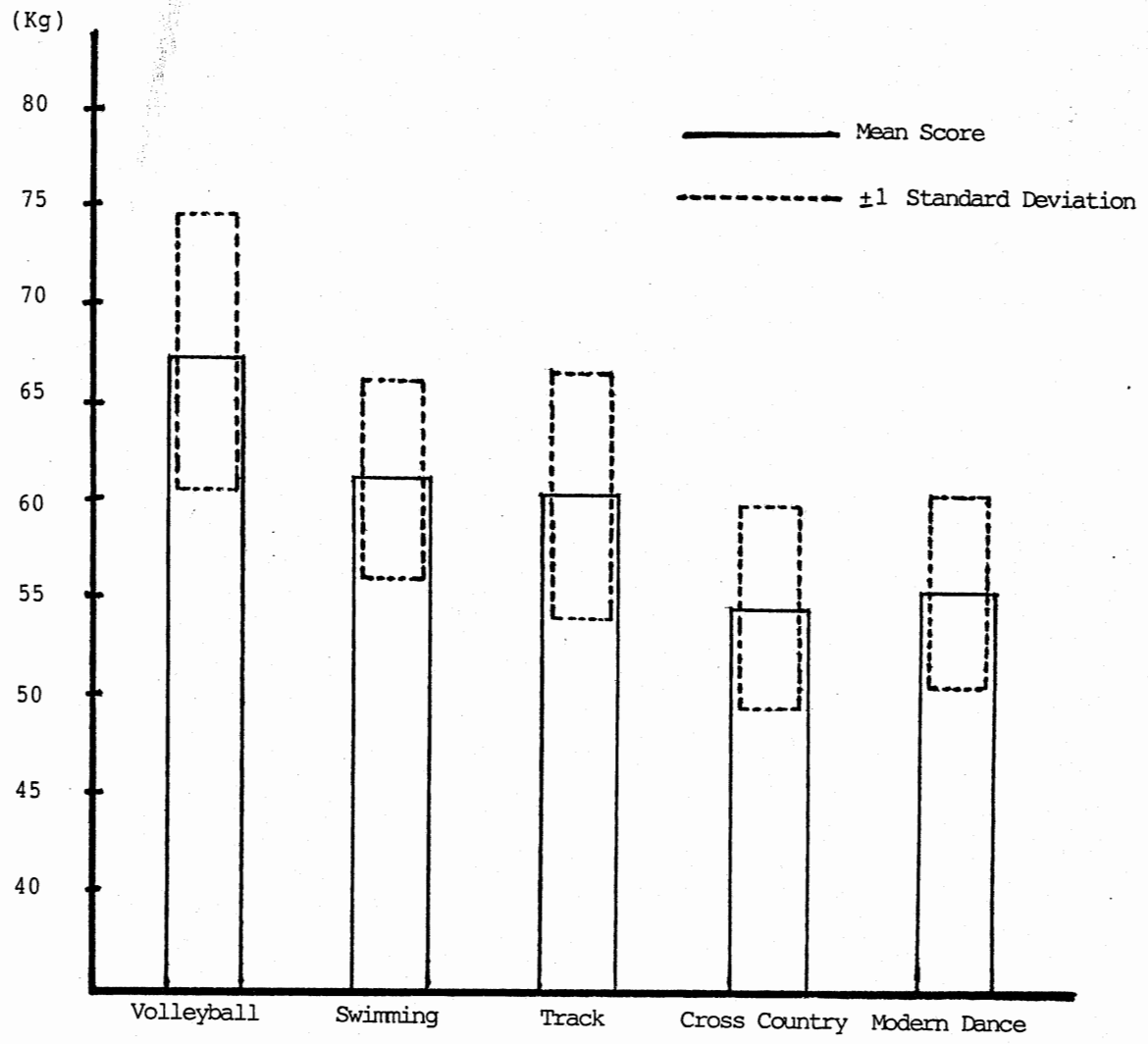

Figure 2

Mean Scores and Standard Deviations of Body Weight for Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

	Mean Body Weight (Kg)	S.D.
Volleyball	67.75	7.07
Swimming	61.34	5.36
Track	60.43	6.64
Modern Dance	55.65	4.91
Cross Country	54.62	5.30

A comparison of the mean scores through use of the t-test indicated there was a difference at the .05 level of significance between the volleyball players, who had the highest body weight, and each of the other groups. The mean body weight of the swimmers was also significantly higher than the cross country runners and the modern dancers. The remaining comparisons of mean body weight scores showed no significant differences.

Comparison of Percent of Body Fat

Table 2 reports the percent of body fat scores for the female athletes in volleyball, swimming, track, cross country, and the modern dance group. Mean scores, standard deviations, and the t-test results are also included.

Following is a summary of the mean percent of body fat scores for each group and their respective standard deviations. These scores are also depicted in Figure 3 in a graphic form.

	Mean Body Weight (Kg)	S.D.
Modern Dance	23.26	2.44
Swimming	21.04	1.89

Table 2

Comparison of Percent of Body Fat Scores among Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

Subject	Volleyball (A)	Swimming (B)	Track (C)	Cross Country (D)	Modern Dance (E)
1	20.08	21.92	17.84	14.05	24.53
2	19.98	18.22	20.94	17.62	19.25
3	15.86	22.95	16.43	17.70	22.44
4	16.00	22.16	17.80	16.58	20.33
5	23.43	21.27	21.98	16.61	25.61
6	20.49	20.66	23.90	15.75	26.06
7	20.75	19.28	15.68	16.18	24.46
8	17.05	19.07	23.63	15.24	23.43
9	24.65	23.83	-	21.23	-
10	22.32	-	-	-	-
11	16.26	-	-	-	-
Mean	19.72	21.04	19.78	16.77	23.26
S.D.	3.07	1.89	3.24	2.02	2.44

Mean Difference

	B	C	D	E
A	1.32	.06	2.95	3.54
B		1.26	4.27	2.22
C			3.01	3.48
D				6.49

t-ratio

	B	C	D	E
A	1.18	.04	2.58*	2.79**
B		.96	4.63***	2.08
C			2.27****	2.43*****
D				5.95****

Significant Difference ($p < .05$) *df = 18; t = 2.101 ****df = 15; t = 2.131
**df = 17; t = 2.110 *****df = 14; t = 2.145
***df = 16; t = 2.120

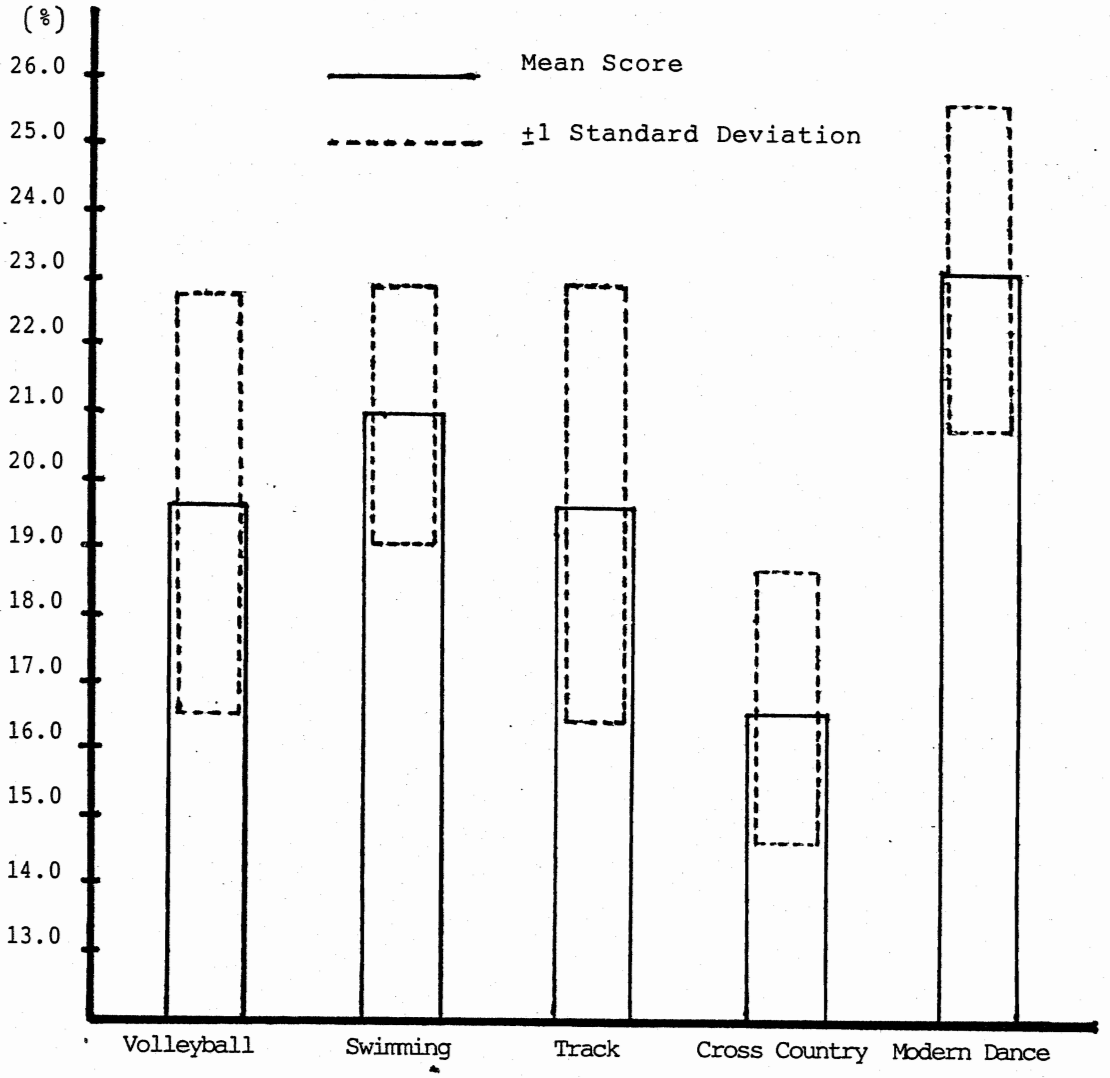

Figure 3

Mean Scores and Standard Deviations of Percent of Body Fat for Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

	Mean Body Weight (Kg)	S.D.
Track	19.78	3.24
Volleyball	19.72	3.07
Cross Country	16.77	2.02

A comparison of the mean scores through use of the t-test indicated there was a difference at the .05 level of significance between the modern dancers, who had the highest percent of body fat, and each of the other groups. Also, there was a significant difference between the cross country runners, who had the lowest percent of body fat, and each of the other groups. The remaining comparisons of percent of body fat showed no significant difference.

Comparison of Flexibility

The hip and lower back flexibility scores in centimeters (Cm) for the female athletes in volleyball, swimming, track, cross country, and the modern dance group along with mean scores, standard deviations, and the t-test results of the comparison of the groups have been presented in Table 3.

Following is a summary of the mean flexibility scores for each group and their respective standard deviations. These scores are also depicted graphically in Figure 4.

	Mean Flexibility Score (Cm)	S.D.
Modern Dance	44.25	5.25
Swimming	42.56	3.41
Volleyball	38.73	3.41

Table 3

Comparison of Flexibility Scores Among Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country and Modern Dance

Subject	Volleyball (A)	Swimming (B)	Track (C)	Cross Country (D)	Modern Dance (E)
1	38.5	46.5	42.0	42.5	50.0
2	37.5	40.5	42.0	35.0	50.0
3	45.0	44.5	40.5	38.0	40.0
4	43.5	39.0	38.0	24.5	45.0
5	68.0	47.0	26.0	32.0	42.5
6	26.0	43.0	31.0	38.5	38.5
7	38.0	44.5	37.5	32.0	50.0
8	24.0	37.0	44.0	30.5	38.0
9	42.0	41.0	-	42.0	-
10	38.5	-	-	-	-
11	45.0	-	-	-	-
Mean	38.73	42.56	37.63	35.00	44.25
S.D.	7.61	3.41	6.17	5.86	5.25

Mean Difference

	B	C	D	E
A	3.83	1.10	3.73	5.52
B		4.93	7.56	1.69
C			2.63	6.62
D				9.25

t-ratio

	B	C	D	E
A	1.50	.35	1.24	1.86
B		2.00	3.34*	.77
C			.34	2.31**
D				3.40***

Significant Difference ($p<.05$) *df = 16; t = 2.120
**df = 14; t = 2.145
***df = 15; t = 2.131

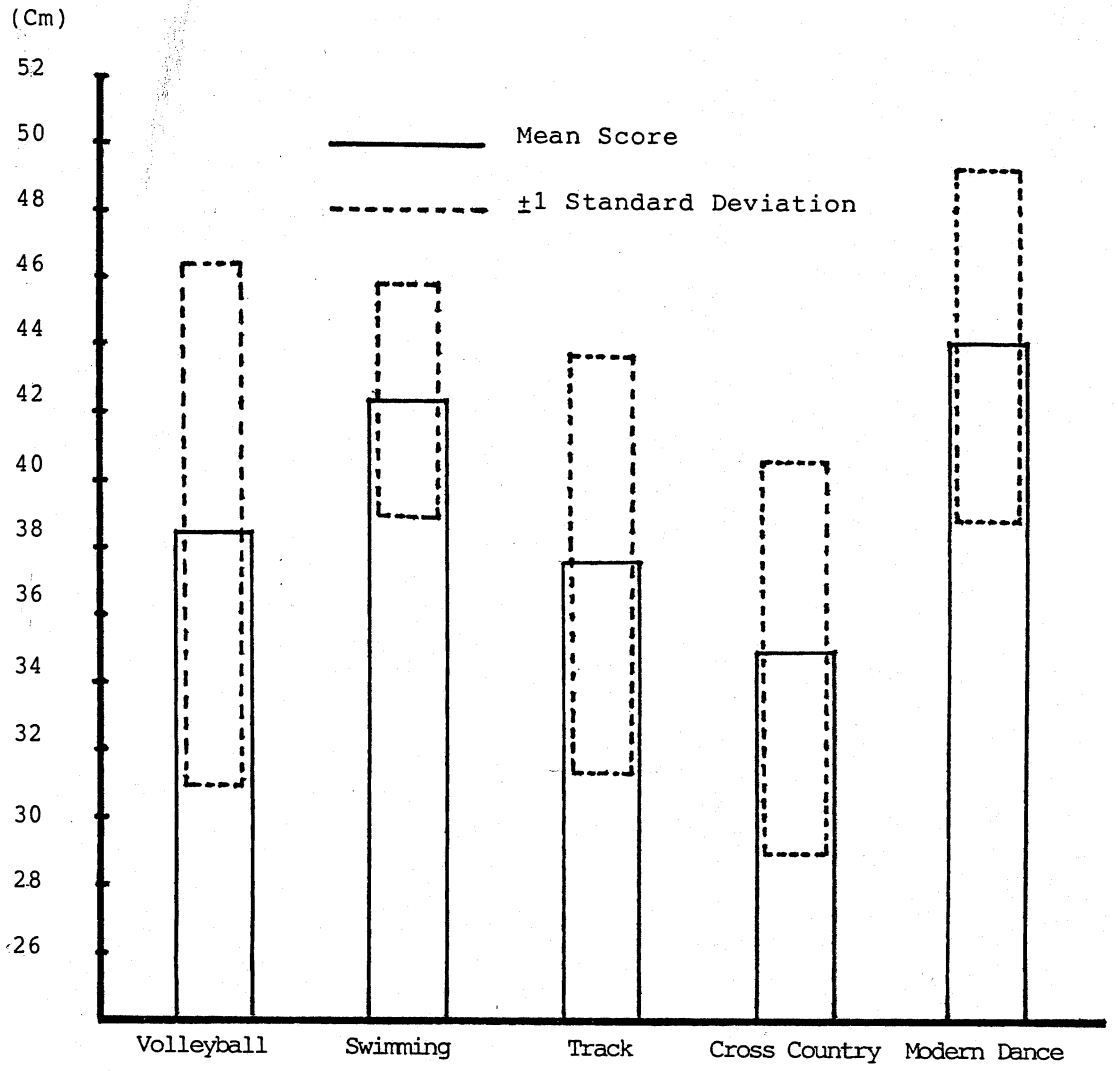

Figure 4

Mean Scores and Standard Deviations of Flexibility for Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

	Mean Flexibility Score (Cm)	S.D.
Track	37.63	6.17
Cross Country	35.00	5.86

The modern dance group had the greatest flexibility which differed significantly at the .05 level from the track sprinters and the cross country runners. The swimmers had the second best flexibility scores and they differed significantly from the cross country runners. The remaining comparisons showed no significant differences.

Comparison of Agility

The agility scores in seconds (sec.) for the female athletes in volleyball, swimming, track, cross country, and the modern dance group along with mean scores, standard deviations, and the t-test results of the comparison of the groups have been placed in Table 4.

Following is a summary of the mean agility scores for each group and their respective standard deviations. These scores are also depicted graphically in Figure 5.

	Mean Agility Score (sec.)	S.D.
Volleyball	10.10	.58
Cross Country	10.97	.59
Track	11.06	.39
Modern Dance	11.49	.64
Swimming	12.00	.73

Table 4

Comparison of Agility Scores among Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

Subject	Volleyball (A)	Swimming (B)	Track (C)	Cross Country (D)	Modern Dance (E)
1	10.2	12.5	11.3	12.0	11.0
2	10.2	12.2	10.7	10.6	11.3
3	9.6	13.6	10.8	11.0	11.8
4	9.1	11.4	11.8	10.5	11.0
5	10.0	11.8	10.8	11.3	12.2
6	10.1	12.1	10.9	10.5	11.8
7	9.8	11.8	10.8	10.2	10.5
8	9.9	11.3	11.4	11.6	12.3
9	10.1	11.3	-	11.0	-
10	10.7	-	-	-	-
11	11.4	-	-	-	-
Mean	10.10	12.00	11.06	10.97	11.49
S.D.	.58	.73	.39	.59	.64

Mean Difference

	B	C	D	E
A	1.90	.96	.87	1.39
B		.94	1.03	.51
C			.09	.43
D				.52

t-ratio

	B	C	D	E
A	6.33*	4.29**	3.35*	4.88**
B		3.32***	3.31****	1.54
C			.37	1.60
D				1.93

Significant Difference ($p<.05$) *df = 18; t = 2.101 ***df = 15; t = 2.131
**df = 17; t = 2.110 ****df = 16; t = 2.120

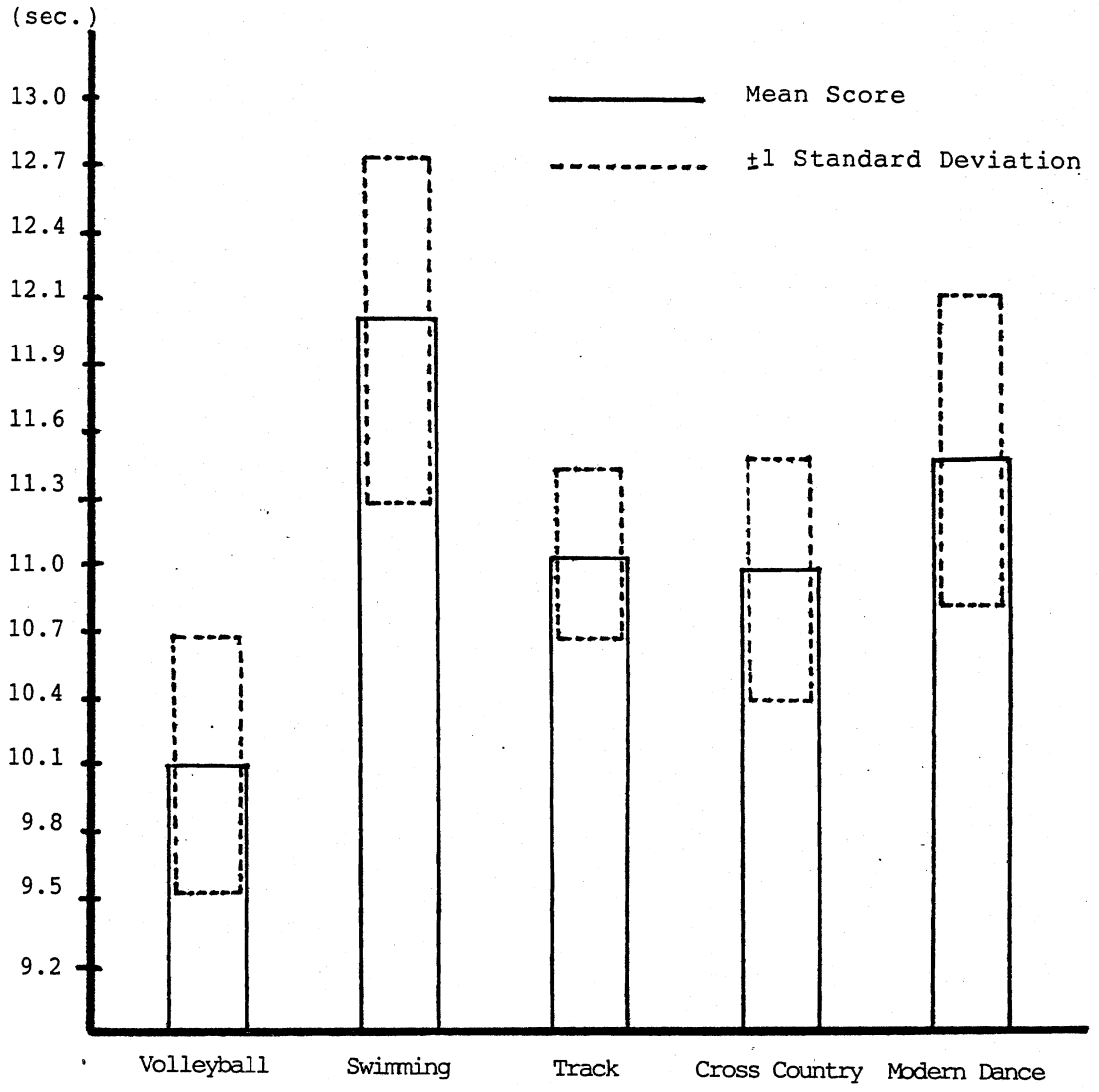

Figure 5

Mean Scores and Standard Deviations of Agility for Collegiate Women Athletes in Volleyball, Swimming, Track, Cross Country, and Modern Dance

A comparison of the mean scores indicated there was a difference at the .05 level of significance between the volleyball players, who had the best agility score, and each of the other groups. The cross country and track groups had the second and third best agility time and they differed significantly from the swimmers who had the highest mean time. The remaining comparisons showed no significant differences.

Discussion

This study was conducted to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track, cross country, and modern dance group. For the purpose of this study, the null hypothesis was assumed to the effect that there is no difference in body weight, percent of body fat, flexibility, and agility between groups of college women varsity athletes in volleyball, swimming, track, and cross country, and modern dancers.

The study found a significant difference between the volleyball players and each of the other groups on body weight and agility. It was also found that the cross country runners differed significantly from each of the other groups on percent of body fat.

In some cases no differences were found at the .05 level in this study. There was no significant difference on body weight between the track sprinters and each of the

swimming, cross country, and modern dance groups and between the cross country runners and the modern dancers.

No significant difference on percent of body fat was found between the volleyball players and the swimmers, between the volleyball players and the track sprinters, between the swimmers and the track sprinters, and between the swimmers and the modern dancers.

On flexibility, there was no significant difference between the volleyball players and each of the other groups, between the swimmers and the track sprinters, between the swimmers and the modern dancers, and between the track sprinters and the cross country runners.

On agility, the modern dancers did not differ significantly from the swimmers, the track sprinters, and the cross country runners; and there was no significant difference between the track sprinters and the cross country runners.

The volleyball players scored the highest body weight and the cross country runners scored the lowest.

The modern dancers had the highest percent of body fat and the best flexibility score, while the cross country runners had the lowest percent of body fat and flexibility score.

The present study found that volleyball players were the most agile, which appeared to support the result of a recent study by Morrow and Hostler (29) who regarded agility and strength as the most important factors for

volleyball players. The swimmers had the lowest agility score and they differed significantly from the track sprinters and the cross country runners.

The findings of this study which revealed the mean percent of body fat of 21.04 for the swimmers were not in agreement with Wilmore (42) in which his study suggested that female swimmers averaged 29.6 percent of body fat.

In agreement with the present study, Morrow and Hostler (30) suggested that volleyball players are most like sprinters when compared on percent of body fat.

Using 35 college female modern dancers, Rosentswieg and Tate (34) found that the dancers had mean percent of body fat of 25.4. This seemed to support the data of the present study when it was found that the modern dancers had 23.26 mean percent, which was the highest when compared with the other four groups.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary of the study, conclusions from the results of the study, and recommendations.

Summary

The purpose of this study was to compare body weight, percent of body fat, flexibility, and agility of collegiate women in volleyball, swimming, track (sprinters), cross country, and modern dance groups.

Thirty-seven female varsity athletes representing volleyball, swimming, track, and cross country groups and eight modern dancers at Eastern Illinois University served as subjects for the investigation. The age range was seventeen to twenty-one.

Body weight was determined by weighing each subject, wearing only athletic top and pants, on a calibrated balance scale. The reading, which was recorded to the nearest half pound, was converted to kilograms by dividing by 2.2.

A Lange Skinfold Caliper was used for the skinfold measurements. Supra-iliac and triceps skinfold measurements were taken to determine body density and percent of body fat. Measurements were taken on the right side of the body with the subject in a standing position. Each skinfold measurement was taken two times and the average of the

two trials was the score. However, when there was more than .5 millimeter difference between the first two trials, the third measurement was taken and the average of the three trials was recorded as the score.

The sit and reach test, using a Trunk Flexibility Tester, was administered to measure the degree of hip and lower back flexion as well as the extention of the hamstring muscles of the legs. The subjects performed leg stretching exercises prior to the test. One practice trial was given. The reading was recorded to the nearest .5 centimeter and the best of three trials was the score.

The SEMO agility test was administered to measure the general agility of the body in maneuvering forward, backward, and sideward. The basketball court was utilized as the testing area. One practice trial was given to each subject before being tested and the best of two trials to the nearest .1 second was recorded as the score.

The t-test for independent samples was applied to determine whether significant differences existed between mean scores of the tests. The .05 level of confidence was selected to denote statistical significance for this study.

Conclusions

Based on the data presented in this study, the null hypothesis is rejected since, in a number of instances, differences exist among the groups tested on body weight, percent of body fat, flexibility, and agility.

1. The groups are different in body weight, with volleyball players heavier than those of all other groups. Swimmers are heavier than cross country runners and modern dancers. There is no difference in body weight among the groups of track, cross country, and modern dance.

2. Modern dancers have the highest percent of body fat, with cross country runners registering the lowest. Modern dancers have a higher percent of body fat when compared to volleyball players, track sprinters, and cross country runners. Volleyball players have a higher percent of body fat than cross country runners. Swimmers and track sprinters have a higher percent of body fat than cross country runners. There are no differences in percent of body fat when comparing volleyball players and swimmers, volleyball players and track sprinters, swimmers and track sprinters, and swimmers and modern dancers.

3. Modern dancers are the most flexible while cross country runners are the least flexible of the groups tested. Modern dancers are more flexible than track or cross country runners, and swimmers are more flexible than cross country runners. There are essentially no differences in flexibility between the remaining groups.

4. Volleyball players are more agile than swimmers, track sprinters, cross country runners, and modern dancers. Track and cross country runners are more agile than swimmers. There are no differences in agility when comparing swimmers to modern dancers, track and cross country partici-

pants, track sprinters and modern dancers, and cross country runners and modern dancers.

Recommendations

On the basis of this study, the following recommendations are warranted.

1. A further study should be undertaken using a variety of tests on each physical performance component. A reliability score should be determined for each test.

2. A similar study should be conducted with a greater number of subjects including sport groups from other institutions.

3. If additional research studies result in similar findings, perhaps further studies should be made to determine cause and effect relationships.

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